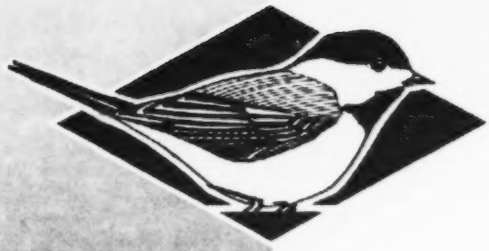


Fish & Wildlife Division

RESOURCE STATUS AND ASSESSMENT BRANCH

2002 Burrowing Owl Trend Block Survey and Monitoring, Brooks Area

Alberta Species at Risk Report No. 58

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

2002 Burrowing Owl Trend Block Survey and Monitoring, Brooks Area

R.F. Russell

Alberta Species at Risk Report No. 58

October 2002

Alberta
SUSTAINABLE RESOURCE DEVELOPMENT

Publication No. I/087
ISBN: 0-7785-2325-X (Printed Edition)
ISBN: 0-7785-2326-8 (On-line Edition)
ISSN: XX (Printed Edition)
ISSN: XX (On-line Edition)

Cover Illustration: Brian Huffman

For copies of this report, contact:

Information Centre – Publications
Alberta Environment/Alberta Sustainable Resource Development
Main Floor, Great West Life Building
9920 108 Street
Edmonton, Alberta, Canada T5K 2M4
Telephone (780) 422-2079

OR

Information Service
Alberta Environment/Alberta Sustainable Resource Development
#100, 3115 – 12 Street NE
Calgary, Alberta, Canada T2E 7J2
Telephone (403) 297- 6674

OR

Visit our web site at:
http://www3.gov.ab.ca/srd/fw/riskspecies/

This publication may be cited as:

Russel, R.F. 2002. 2002 Burrowing Owl Trend Block Survey and Monitoring, Brooks Area. Alberta Sustainable Resource Development, Fish and Wildlife Division. Alberta Species at Risk Report No. 58, Edmonton, AB 10 pp.

TABLE OF CONTENTS

ABSTRACT.....vi

ACKNOWLEDGEMENTS.....vi

DISCLAIMER.....vi

1.0 INTRODUCTION.....1

2.0 STUDY AREA.....1
2.1 Kininvie.....1

3.0 METHODS.....3
3.1 Kininvie Area.....3
3.2 Burrowing Owl Survey Protocol 2002.....3
3.3 Productivity Monitoring.....4

4.0 RESULTS.....5

5.0 DISCUSSION.....8

6.0 MANANGEMENT IMPLICATIONS AND FUTURE DIRECTIONS.....9

7.0 LITERATURE CITED.....9

LIST OF FIGURES

Figure 1. Location of burrowing owl trend blocks (K-blocks) in the Brooks area 2
Figure 2. Number of burrowing owl nests per 100 km^2, K-block surveys, 1993-2002 6
Figure 3. The average density of nests in the Brooks study area over time (polynomial regression). 6
Figure 4. Average number of juvenile burrowing owls observed per successful nest-site during K-block productivity monitoring, 1993-2002. 8

LIST OF TABLES

Table 1. Dates of burrowing owl trend block surveys, K-blocks, 1993-2002. 3
Table 2. Results of 2002 burrowing owl K-block trend survey. 5
Table 3. Results of 2002 burrowing owl K-block productivity monitoring 7
Table 4. Number of sucessful burrowing owl nests observed during K-block productivity monitoring, 1993-2002. 8
Table 5. Average number of juvenile burrowing owls observed per successful nest-site during K-block productivity monitoring, 1993-2002. 8

ABSTRACT

Surveys were conducted in the Brooks area (K-blocks) during June 18-27, 2002. Five (5) burrowing owl nest sites and 2 single owls were found in the K-blocks. Productivity monitoring was undertaken in the K-blocks during July 16–21, resulting in 2.80 young per successful nest (n=5). Although there is some reference to the Hanna Blocks in this report, they were not surveyed in 2002.

ACKNOWLEDGEMENTS

Appreciation is extended to the main trend block surveyors, Corey Scobie, Dave Scobie, and Darcey Shyry (Avocet Environmental Inc.). Joel Nicholson, John Taggart, Reg Russell (Alberta Sustainable Resource Development, Fish and Wildlife Division) and Corey Skiftun (Alberta Conservation Association) either participated in the trend block surveys and/or assisted with the productivity monitoring. Arlen Todd and Michelle MacLean (Alberta Sustainable Resource Development) provided editorial assistance. Joel Nicholson and Kelley Kissner (Alberta Sustainable Resource Development, Fish and Wildlife Division) provided review comments. The Alberta Species at Risk Program (Alberta Sustainable Resource Development) provided funding.

A special note of appreciation is extended to the Eastern Irrigation District for allowing the continuation of these surveys.

DISCLAIMER

The opinions and recommendations expressed are those of the author, and not necessarily those of Alberta Sustainable Resource Development.

1.0 INTRODUCTION

The burrowing owl (*Athene cunicularia)* is a small bird of prey about the size of a Richardson's ground squirrel (*Spermophilus richarsonii).* Burrowing owls are unique in that they use the abandoned burrows of ground squirrels (*Spermophilus* spp.), badgers (*Taxidea taxus)* and prairie dogs (*Cynomys* spp.) for nesting, roosting and caching food. The species is found in well-drained grasslands, prairies, steppes, deserts, and agricultural areas in the Americas from Canada to Argentina and Chile (Haug et al 1993). In Canada, burrowing owls were formerly found widely, but often sparsely, distributed across grassland regions of the prairie provinces, and in the interior of British Columbia (Wedgwood 1978); they are now only found in Alberta and Saskatchewan. These populations are migratory, with the birds arriving in mid-April or early May and beginning to nest shortly afterwards. They migrate southward to wintering areas in the southern United States or Mexico (James 1992, G. Holroyd, pers. comm.) in late September and early October.

Burrowing owl populations declined dramatically over much of western North America over the last half of the 20th century. Wellicome (1997) discusses direct and indirect limiting factors attributed to human activities. These limiting factors (in no order of ranking) are habitat loss and degradation, mortality on migration or wintering grounds, pesticides, predation, collision with vehicles and shooting.

In North America, the burrowing owl is ranked 'G4' with widespread distribution: relatively common in appropriate habitat in some areas, but habitat alteration and other factors are causing population declines in many areas (Nature Serve 2001). In most northern Great Plains states, it is considered a 'species of special concern' (Haug et al 1993, Martell 1991, Marti and Marks 1989). In Canada, the burrowing owls is listed as 'endangered' (a species facing imminent extirpation or extinction) by the Committee on the Status of Endangered Wildlife in Canada (2001); it is designated as 'threatened' in Alberta (Alberta Sustainable Resource Development 2001).

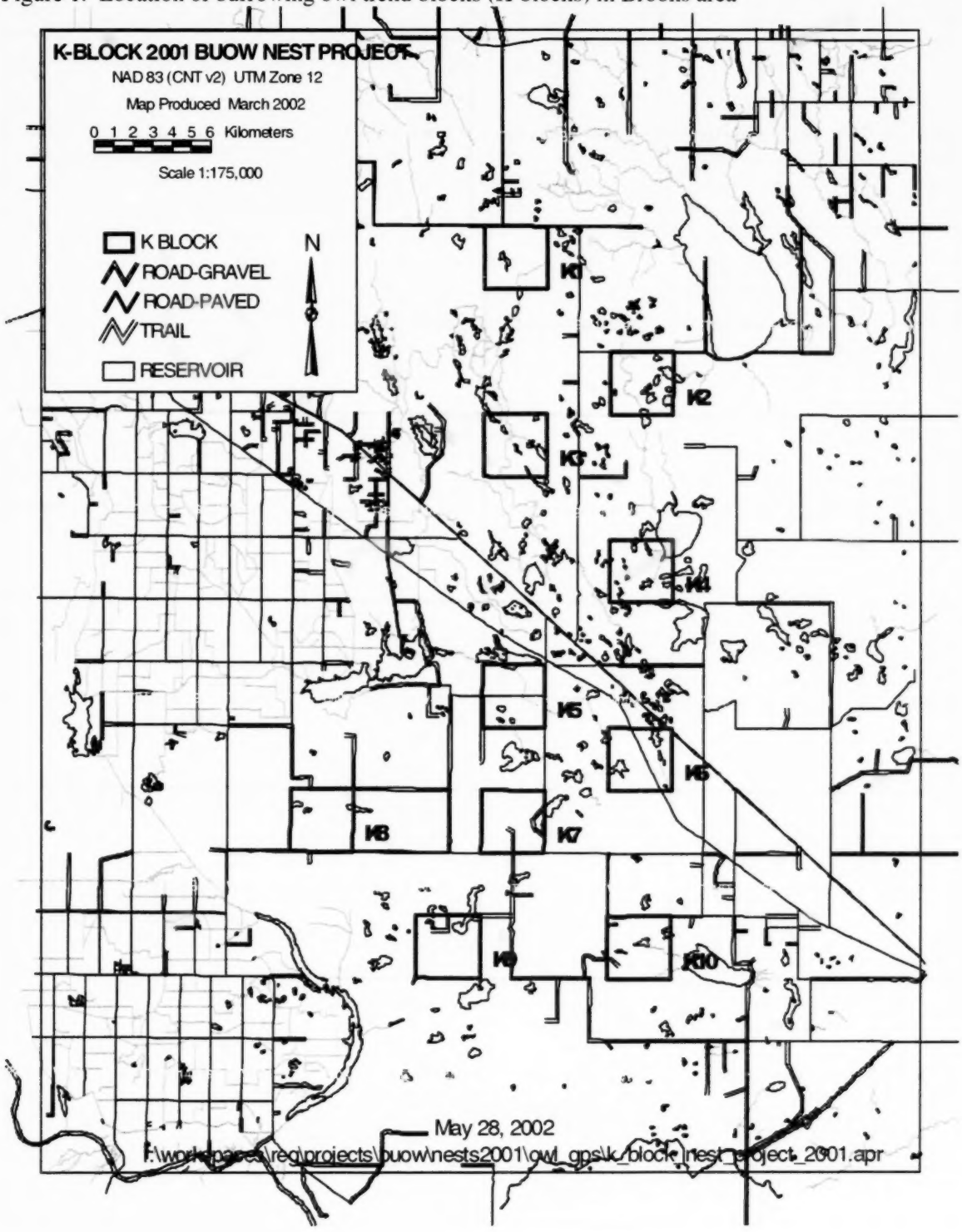
Trend block surveys in Alberta began in 1991 near Hanna (H-blocks), and in 1993 near Brooks (K-blocks). The K-block surveys focused on locating burrowing owl sites within 160 permanent quarter section plots, following a standardized survey protocol. The ten K-blocks were selected at random. Other species of national and/or provincial concern were recorded as incidental observations. Monitoring of these permanent trend blocks allows researchers to compare population trends using a standardized survey protocol (Shyry 1999). Shyry (1999) provided a detailed description with rationale and summary for five years of these surveys; many of the figures and tables presented in this report were derived from Shyry (1999) and updated, as required.

2.0 STUDY AREA

2.1 Kininvie

This study area is referred to as the K-blocks (the terms Brooks and Kininvie are used interchangeably) and is comprised of 160-quarter sections in 10 regularly shaped blocks located in the County of Newell, Alberta (Figure 1). The K-blocks are situated approximately 35 km south and east of Brooks, bounded by Highway 544 to the north and, to the south, by Highway 524.

Figure 1. Location of burrowing owl trend blocks (K-blocks) in Brooks area



Habitat within the area is comprised primarily of undulating native prairie with the exception of Block 4, which is interspersed with tame grass (i.e. crested wheat grass (*Agropyron cristatum*)).

The K-block study areas lie within the dry mixed grass ecoregion of southeastern Alberta. The climate is characterised by hot, dry summers and cold winters (Strong 1992). The median annual precipitation in the region is 272 mm (Strong 1992). Native rangelands are dominated by *Stipa-Bouteloua-Agropyron* vegetation communities (Strong 1992, Coupland 1961).

3.0 METHODS

3.1 Kininvie Area

The 10 survey blocks in the County of Newell encompass 160 quarter sections. The dates of previous surveys can be found in Table 1. In 1993 only 128 quarters were surveyed. The K-blocks are on land owned by the Eastern Irrigation District (EID).

Table 1. Dates of burrowing owl trend block surveys, K-blocks, 1993-2002.

Year	Brooks
1993	June 21 - July 20
1994	June 21 - June28
1995	June 19 - July 28
1996	No Survey
1997	June 7 - June 27
1998	June 17 - June25
1999	June 14 – June 19
2000	June 12 – June 21
2001	June 18 – June 22
2002	June 17- June 24

3.2 Burrowing Owl Survey Protocol 2002

Each quarter section (0.8 km by 0.8 km) had a GPS location for the center of the quarter. The K-blocks by design are 16 quarters per 'block' (3.2 km by 3.2 km).

Two observers were required per quarter. Elevated points were strategically chosen for best visibility roughly 1-200 m from the center. The all terrain vehicle (ATV) was shut down, waiting 5 minutes to let the effect of disturbance subside, while making a 360° pan of the quarter with aid of binoculars or spotting scope. The taped primary call was played for 5 minutes while scanning the area during the call. The caller was placed above the cargo box and the speaker rotated equally in each direction. Any nests/roosts or possible sightings were investigated before going on to the next quarter. Any 'out of block' burrowing owl sightings were also investigated and recorded.

Surveys were not conducted on rainy days or days with wind speeds greater than approximately 20 km/hr., B-4 on the Beaufort Windscale. Surveys began at approximately 0600 and were usually completed by 1430.

When no young were seen, the minimum requirement for determining if a burrow was a nest included: the presence of nest material (dung) in the burrow entrance, the presence of prey, pellets or prey parts, loose soil across the breadth of the burrow floor, feathers and whitewash. All pertinent owl evidence was recorded and an explanation given on the datasheet. If owls were detected after the 10-minute observation period, they were recorded with a clear note to explain where they were, how they were found and why they were missed. Adherence to the established protocol conducted by experienced observers ensures that bias is minimized between observers and different years.

Navigation and georeferenced locations were recorded in the North American Datum 83 Universal Transverse Mercator format and achieved with Garmin™ 12 and 12XL Global Position System units. A permanent marker pin was placed 1 m away from the head of the burrow (area opposite the mound).

To maximize the amount of information obtained, additional data was recorded on plots including land use, human occupation, and % visibility. The following other species were also recorded on a presence/absence basis: ferruginous hawk, swainson's hawk, short-eared owl, Baird's sparrow, upland sandpiper, loggerhead shrike, long-billed curlew and any other uncommon fauna. Burrowing owl feathers were also collected at nest sites as part of a stable isotope project being conducted at the University of Alberta.

Two 800 m Richardson's ground squirrel transects were also conducted per block, including recording burrows on either side of the ATV up to 1 meter away, resulting in 3200m^2 surveyed. Additionally, concurrent to the Trend Block survey, a nest occupancy analysis was conducted (R. Russell, unpublished data).

3.3 Productivity Monitoring

Monitoring began one week after the first owlets were observed at a number of control nest sites within the EID.

The protocol involved the observer positioning himself at a distance so as not to influence the owls' behaviour or at a distance equal to the nearest existing above ground disturbance (e.g., road, well site, etc.) The observer then counted the total number of young observed, with the aid of binoculars or a spotting scope, during continual observation for a monitoring period of 30 minutes.

Monitoring was undertaken during times of peak owl activity that occurs in early morning and early evening. Optimal monitoring times were 3 hours beginning one-half hour before sunrise and another 3-hour period ending one-half hour after sunset.

Monitoring was conducted with three visits on different days and the maximum number of owlets observed at a visit was used to determine productivity at the nest.

4.0 RESULTS

The 2002 K-block surveys occurred during June 17-24 (See Table 1). All 160-quarter sections were completed in the K-blocks.

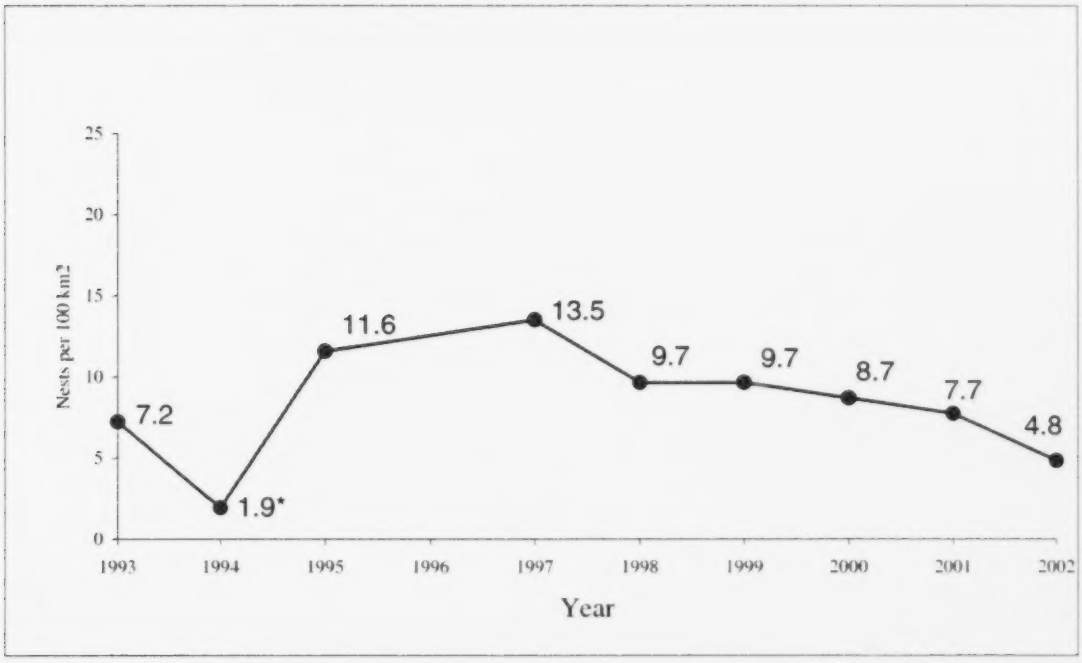
The 11 sites found during the survey are detailed in Table 2. This table includes two sites that were determined to not be nests ("not marked" site and "roost" site), as well as two nests that were missed during the K-block survey itself, but located during the companion survey (R.Russell, unpubl. data). Additionally, one "off block" site was found outside of the K-block study area and is included in Table 2. The numbers of burrowing owl nests per 100 km^2 are detailed in Figure 2.

Table 3 details the results of the productivity monitoring undertaken July 16-21. Table 4 provides a summary of successful nests found in the Brooks area from 1993-2002. The average number of juvenile owls that were observed per successful nest site is presented in Table 5 and Figure 3.

Table 2. Results of 2002 burrowing owl K-block trend survey.

BURROWING OWL K-BLOCK RESULTS 2002				
WPT	DATE	K-BLOCK	TOTAL # OF OWLS	BURROW NUMBER
BO200201	17-Jun	1	2	614-27389
BO200202	17-Jun	2	1	816-16531
BO200203	17-Jun	2	1	614-27395
BO200204	17-Jun	2	2	Not Marked
BO200205	18-Jun	3	1	Roost
BO200206	24-Jun	3	2	745-02514
BO200207	24-Jun	3	2	745-02512
BO200208	24-Jun	3	1	BWC 073
MISSED IN SURVEY				
BO200103	25-Jun	6	1	BWC 064
BO200209	18-Jun	2	1	BWC 022
OFF BLOCK				
1	24-Jun	6	1	Off Block
TOTAL OWLS OBSERVED			15	
TOTAL OWLS IN BLOCK			12	
TOTAL OWLS OFF BLOCK			1	
TOTAL LOCATIONS			11	
LOCATIONS INSIDE K-BLOCKS			8	
LOCATIONS OUTSIDE BLOCK			1	
LOCATIONS MISSED IN SURVEY			2	
0	YOY OBSERVED DURING K-BLOCK SURVEY			
14	YOY OBSERVED IN PRODUCTIVITY SEARCHES			
5	2002 BURROWS WERE MARKED			

Figure 2. Number of burrowing owl nests per 100 km^2, K-block surveys, 1993-2002.



* Not complete survey (less area surveyed)

Figure 3. The average density of nests in the Brooks study area over time (polynomial regression).

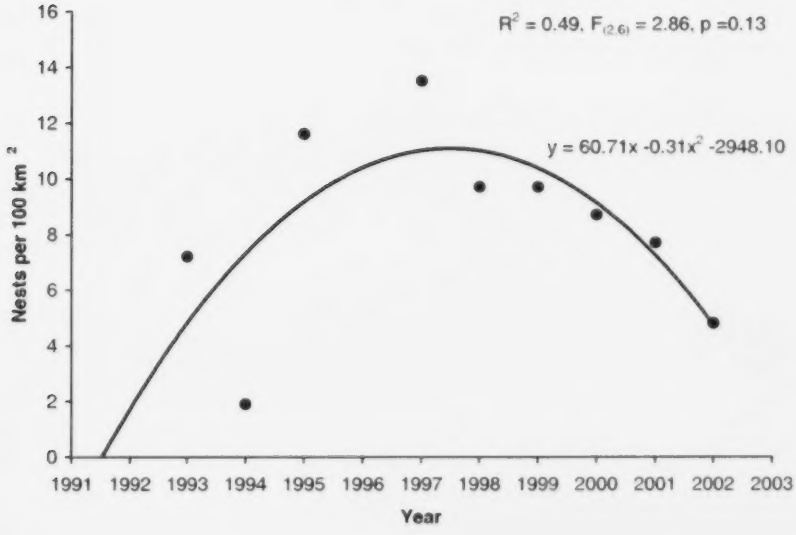


Table 3. Results of 2002 burrowing owl K-block productivity monitoring.

BURROWING OWL K-BLOCK PRODUCTIVITY 2002

WPT	DATE	K-BLK	INITIAL	BURROW	PRODUCTIVITY SEARCH					
			# OWLS	NUMBER	VISITS			MAXIMUM		STATUS
					DATES	Adults	YOY	Adults	YOY	
BO200201	17-Jun	1	**2**	614-27389	16-Jul	2	0	2	1	Nest
					18-Jul	2	1			
					19-Jul	1	**1**			
BO200202	17-Jun	2	**1**	816-16531	16-Jul	1	0	1	0	Single
BO200108	16-Jul	2	**1**	614-27394	16-Jul	2	2	2	3	Nest
BO200209	*	*	*	BWC 022	18-Jul	2	3			
					19-Jul	1	**3**			
BO200203	17-Jun	2	**1**	614-27395	18-Jul	1	**4**	1	4	Nest
					19-Jul	0	2			
					21-Jul	0	3			
BO200204	17-Jun	2	**2**	-	18-Jul	0	0	2	0	Failed
BO200205	18-Jun	3	**1**	-				1	0	Roost
BO200206	24-Jun	3	**2**	745-02514	18-Jul	2	4	2	4	Nest
					19-Jul	1	3			
					21-Jul	2	**4**			
BO200207	24-Jun	3	**2**	745-02512	16-Jul	0	0	2	0	Failed
BO200208	24-Jun	3	**1**	BWC 073	18-Jul	2	2	2	2	Nest
					19-Jul	2	2			
					21-Jul	2	**2**			
						Total		**15**	**14**	
					Average # of juveniles observed/successful nest				**2.80**	
						Total # Nests				5
						Total # Failed				2
						Total #Singles				1

* This nest was "missed in survey" (Table 2)

Note: Bold indicates maximum # of owls observed

Missed during the survey therefore not included in totals.

BO200103	25-Jun	6	**1**	BWC 064	18-Jul	1	3	2	5	Nest
					19-Jul	2	**5**			
					21-Jul	1	2			
				The totals if this nest was included:						
						Total		**17**	**19**	
					Average # of juveniles observed/successful nest				3.17	
						Total # Nests				6
						Total # Failed				2
						Total #Singles				1

Table 4. Number of successful burrowing owl nests observed during K-block productivity monitoring, 1993-2002.

Year	1993*	1994	1995	1996	1997	1998	1999	2000	2001	2002
Brooks	6*	2	12	N/S	14	10	10	9	8	5

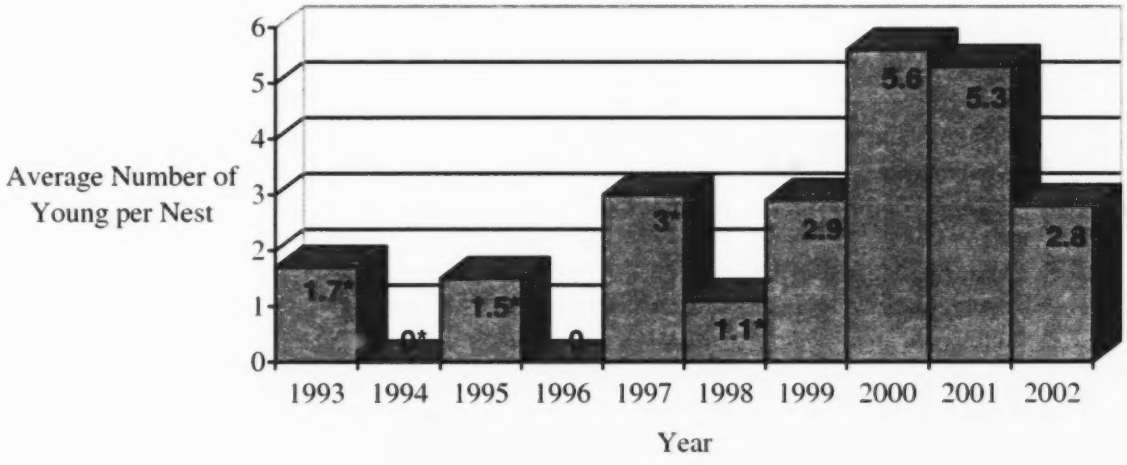
* Not complete survey (less area surveyed); N/S = No survey done

Table 5. Average number of juvenile burrowing owls observed per successful nest-site during K-block productivity monitoring, 1993-2002.

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Brooks	1.7*	0*	1.5*	N/S	3.0*	1.1*	2.9	5.6	5.3	2.8

* No formal productivity surveys performed until 1999. 1993-1998 are incidental observations
N/S = No survey done

Figure 4. Average number of juvenile burrowing owls observed per successful nest-site during K-block productivity monitoring, 1993-2002.



* Incidental Observations

5.0 DISCUSSION

Two crews completed the K-block surveys over an 8-day period. Poor weather caused delays. The number of successful nests located is down from 8 to 5 (-40 %). These reduced numbers may be a result of low prey populations. This was the third year of a drought with below normal snow accumulation, and subsequently a lack of voles and other foods. The number of juvenile owls per successful nest in 2002 was lower than the 2001 results (only 2.8 juveniles in 2002, compared to 5.3 in 2001--a 47% decline). This may also be an indication of the lack of available foods.

Table 4. Number of successful burrowing owl nests observed during K-block productivity monitoring, 1993-2002.

Year	1993*	1994	1995	1996	1997	1998	1999	2000	2001	2002
Brooks	6*	2	12	N/S	14	10	10	9	8	5

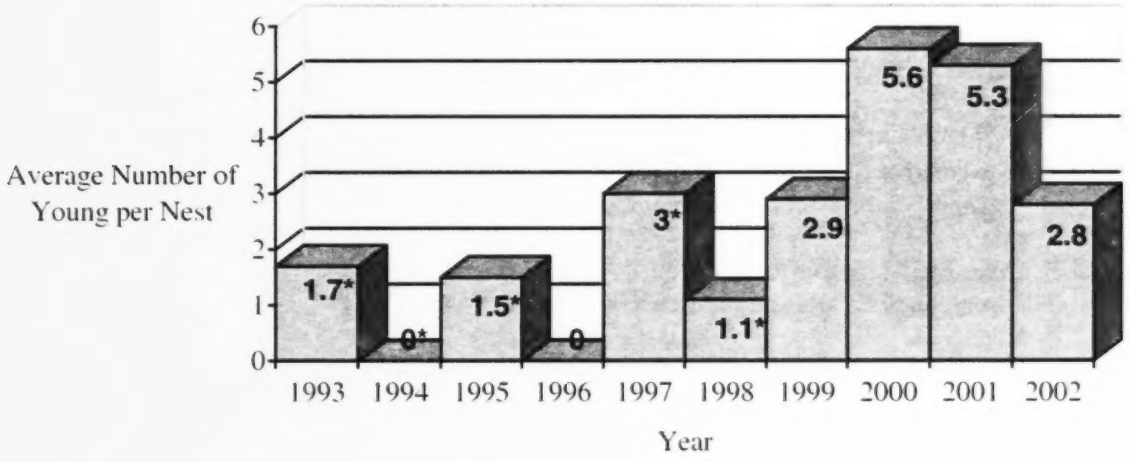
* Not complete survey (less area surveyed); N/S = No survey done

Table 5. Average number of juvenile burrowing owls observed per successful nest-site during K-block productivity monitoring, 1993-2002.

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Brooks	1.7*	0*	1.5*	N/S	3.0*	1.1*	2.9	5.6	5.3	2.8

* No formal productivity surveys performed until 1999. 1993-1998 are incidental observations
N/S = No survey done

Figure 4. Average number of juvenile burrowing owls observed per successful nest-site during K-block productivity monitoring, 1993-2002.



* Incidental Observations

5.0 DISCUSSION

Two crews completed the K-block surveys over an 8-day period. Poor weather caused delays. The number of successful nests located is down from 8 to 5 (-40 %). These reduced numbers may be a result of low prey populations. This was the third year of a drought with below normal snow accumulation, and subsequently a lack of voles and other foods. The number of juvenile owls per successful nest in 2002 was lower than the 2001 results (only 2.8 juveniles in 2002, compared to 5.3 in 2001--a 47% decline). This may also be an indication of the lack of available foods.

Further efforts were made to evaluate the use and status of any previously recorded nest sites in the blocks. Two additional nests were located that were missed in the Trend Survey, which represents a "confidence limit" of 13/15 or 85% (Reg Russell, unpubl. data).

6.0 MANAGEMENT IMPLICATIONS AND FUTURE DIRECTIONS

The need to keep landholders informed on both Federal and Provincial Government initiatives involving species at risk is paramount if managers are to be successful in their efforts. A close working relationship exists between Alberta Sustainable Resource Development and the Eastern Irrigation District in the Brooks area. The continuation of these surveys will only be successful if landholders concerns are alleviated. A previous 3-year agreement for the exchange of information and access for the survey will expire in April 2003. Plans are being made to extend this Memorandum of Understanding.

The trend block surveys provide the only rigorous measure of how burrowing owl numbers are being maintained during the breeding season in Alberta. Further information for the wintering months would enhance the overall picture. A continuation of the survey for 2003 will require additional advance preparation time and additional funding. There is a good possibility the trend surveys for the Hanna area will be re-established for 2003.

7.0 LITERATURE CITED

Alberta Sustainable Resource Development. 2001. The general status of Alberta wild species 2000. Fish and Wildlife Service, Edmonton, Alberta, Canada. 46 pp.

Alberta Wildlife Management Division. 1996. The status of Alberta wildlife. Alberta Natural Resources Service. Edmonton, Alberta. 44 pp.

COSEWIC. 2001. Canadian Species at Risk, May, 2001. Committee on the Status of Endangered Wildlife in Canada, Ottawa, Ontario, Canada. 31 pp.

Coupland, R.T. 1961. A reconsideration of grassland classification in the northern great plains of North America. Journal of Ecology 49: 135-167.

Haug, E.A. 1985. Observations on the breeding ecology of Burrowing Owls in Saskatchewan. M.Sc. thesis, Univ. of Saskatchewan, Saskatoon.

Haug, E.A., B.A. Millsap, and M.S. Martell. 1993. Burrowing Owl (*Speotyto cunicularia*). In: The Birds of North America, No. 61 (A. Poole and F. Gill, Eds.). Philadelphia: The Academy of Natural Sciences; Washington, D.C.: The American Ornithologists' Union.

James, P.C. 1992. Where do Canadian Burrowing Owls spend the winter? Blue Jay 50: 93-95.

Kjearsgaard, A.A. and W.W. Pettapiece. 1986. Soils of the Medicine Hat area (72L/SE and 72L/SW). Agriculture Canada, Research Branch, Land Resource Research Centre, Edmonton, Alberta. Map scale 1:126,720. LRRC contribution no. 90-24.

Martell, M.S. 1991. Grassland owls. Nat. Wildl. Fed. Sci. Tech. Ser. 15:96-104.

Marti, C.D. and J.S. Marks. 1989. Medium sized owls. Natl. Wildl. Fed. Sci. Tech. Ser. 12:124-133.

NatureServe: An online encyclopedia of life [web application]. 2001. Version 1.5 . Arlington, Virginia, USA: Association for Biodiversity Information. Available: http://www.natureserve.org/. (Accessed: October 9, 2001).

Schmutz. J.K. 1994. A census of breeding burrowing owls in southern Alberta: 1994. Prepared for Alberta Environmental Protection, Natural Resource Service, Wildlife Management Division, Nongame Unit. Edmonton. 15 pp. + appendices.

Shyry, D.T. 1999. A summary report on Burrowing Owl (Athene cunicularia) population trend surveys in southern Alberta: 1991-1998. Alberta Environment, Wildlife Management Division, Occasional Paper, Alberta Natural Resources Service, Edmonton, AB. 16 pp.

Scobie, D. 2001. 2001 Burrowing Owl Trend Block Survey and Monitoring, Brooks and Hanna Areas. Alberta Species at Risk Report No. 51. 12pp. + appendix.

Strong Ecological Land Survey Ltd. 1992. Ecoregions and ecodistricts of Alberta Volume 1. Alberta Forestry, Lands and Wildlife, Edmonton, Alberta. 77 pp.

Wedgewood, J.A. 1978. The status of the Burrowing Owl in Canada. A report prepared for the Committee on the Status of Endangered Wildlife in Canada. Canadian Wildlife Service, Ottawa, Ontario. 84 pp.

Zarn, M. 1974. Burrowing Owl. Rept. No. 11. Habitat management series for unique or endangered species. Bureau of Land Management, Denver, Colorado. 25pp.

List of Titles in This Series
(as of October 2002)

No. 1 Alberta species at risk program and projects 2000-2001, by Alberta Sustainable Resource Development, Fish and Wildlife Division. (2001)

No. 2 Survey of the peregrine falcon (*Falco peregrinus anatum*) in Alberta, by R. Corrigan. (2001)

No. 3 Distribution and relative abundance of the shortjaw cisco (*Coregonus zenithicus*) in Alberta, by M. Steinhilber and L. Rhude. (2001)

No. 4 Survey of the bats of central and northwestern Alberta, by M.J. Vonhof and D. Hobson. (2001)

No. 5 2000 survey of the Trumpeter Swan (*Cygnus buccinator*) in Alberta, by M.L. James and A. James. (2001)

No. 6 2000/2001 Brassy Minnow inventory at Musreau Lake and outlet, by T. Ripley. (2001)

No. 7 Colonial nesting waterbird survey in the Northwest Boreal Region – 2000, by M. Hanneman and M. Heckbert. (2001)

No. 8 Burrowing owl trend block survey and monitoring - Brooks and Hanna areas, by D. Scobie and R. Russell. (2000)

No. 9 Survey of the Lake Sturgeon (*Acipenser fulvescens*) fishery on the South Saskatchewan River, Alberta (June-September, 2000), by L.A. Winkel. (2000)

No. 10 An evaluation of grizzly bear-human conflict in the Northwest Boreal Region of Alberta (1991-2000) and potential mitigation, by T. Augustyn. (2001)

No. 11 Harlequin duck monitoring in the Northern East Slopes of Alberta: 1998-2000 preliminary results, by J. Kneteman and A. Hubbs. (2000)

No. 12 Distribution of selected small mammals in Alberta, by L. Engley and M. Norton. (2001)

No. 13 Northern leopard frog reintroduction. Raven River - Year 2 (2000), by K. Kendell. (2001)

No. 14 Cumulative effects of watershed disturbances on fish communities in the Kakwa and Simonette watersheds. The Northern Watershed Project. Study 3 Progress report, by T. Thera and A. Wildeman. (2001)

No. 15 Harlequin duck research in Kananaskis Country in 2000, by C.M. Smith. (2001)

No. 16 Proposed monitoring plan for harlequin ducks in the Bow Region of Alberta, by C.M. Smith. (2001)

No. 17 Distribution and relative abundance of small mammals of the western plains of Alberta as determined from great horned owl pellets, by D. Schowalter. (2001)

No. 18 Western blue flag (*Iris missouriensis*) in Alberta: a census of naturally occurring populations for 2000, by R. Ernst. (2000)

No. 19 Assessing chick survival of sage grouse in Canada, by C.L. Aldridge. (2000)

No. 20 Harlequin duck surveys of the Oldman River Basin in 2000, by D. Paton. (2000)

No. 21 Proposed protocols for inventories of rare plants of the Grassland Natural Region, by C. Wallis. (2001)

No. 22 Utilization of airphoto interpretation to locate prairie rattlesnake (*Crotalus viridis viridis*) hibernacula in the South Saskatchewan River valley, by J. Nicholson and S. Rose. (2001)

No. 23 2000/2001 Progress report on caribou research in west central Alberta, by T. Szkorupa. (2001)

No. 24 Census of swift fox (*Vulpes velox*) in Canada and Northern Montana: 2000-2001, by A. Moehrenschlager and C. Moehrenschlager. (2001)

No. 25 Population estimate and habitat associations of the long-billed curlew in Alberta, by E.J. Saunders. (2001)

No. 26 Aerial reconnaissance for piping plover habitat in east-central Alberta, May 2001, by D.R.C. Prescott. (2001)

No. 27 The 2001 international piping plover census in Alberta, by D.R.C. Prescott. (2001)

No. 28 Prairie rattlesnake (*Crotalus viridis viridis*) monitoring in Alberta – preliminary investigations (2000), by S.L. Rose. (2001)

No. 29 A survey of short-horned lizard (*Phrynosoma hernandesi hernandesi*) populations in Alberta, by J. James. (2001)

No. 30 Red-sided garter snake (*Thamnophis sirtalis parietalis*) education and relocation project – final report, by L. Takats. (2002)

No. 31 Alberta furbearer harvest data analysis, by K.G. Poole and G. Mowat. (2001)

No. 32 Measuring wolverine distribution and abundance in Alberta, by G. Mowat. (2001)

No. 33 Woodland caribou (*Rangifer tarandus caribou*) habitat classification in northeastern Alberta using remote sensing, by G.A. Sanchez-Azofeifa and R. Bechtel. (2001)

No. 34 Peregrine falcon surveys and monitoring in the Parkland Region of Alberta, 2001, by R. Corrigan. (2002)

No. 35 Protocol for monitoring long-toed salamander (*Ambystoma macrodactylum*) populations in Alberta, by T. Pretzlaw, M. Huynh, L. Takats and L. Wilkinson. (2002)

No. 36 Long-toed salamander (*Ambystoma macrodactylum*) monitoring study in Alberta: summary report 1998-2001, by M. Huynh, L. Takats and L. Wilkinson. (2002)

No. 37 Mountain plover habitat and population surveys in Alberta, 2001, by C. Wershler and C. Wallis. (2002)

No. 38 A census and recommendations for management for western blue flag (*Iris missouriensis*) in Alberta, by R. Ernst. (2002)

No. 39 Columbian mountain amphibian surveys, 2001, by D. Paton. (2002)

No. 40 Management and recovery strategies for the Lethbridge population of the prairie rattlesnake, by R. Ernst. (2002)

No. 41 Western (*Aechmophorus occidentalis*) and eared (*Podiceps nigricollis*) grebes of central Alberta: inventory, survey techniques and management concerns, by S. Hanus, H. Wollis and L. Wilkinson. (2002)

No. 42 Northern leopard frog reintroduction – year 3 (2001), by K. Kendell. (2002)

No. 43 Survey protocol for the northern leopard frog, by K. Kendell. (2002)

No. 44 Alberta inventory for the northern leopard frog (2000-2001), by K. Kendell. (2002)

No. 45 Fish species at risk in the Milk and St. Mary drainages, by RL&L Environmental Services Ltd. (2002)

No. 46 Survey of the loggerhead shrike in the southern aspen parkland region, 2000-2001, by H. Kiliaan and D.R.C. Prescott. (2002)

No. 47 Survey of native grassland butterflies in the Peace parkland region of northwestern Alberta – 2001, by M. Hervieux. (2002)

No. 48 Caribou range recovery in Alberta: 2001/02 pilot year, by T. Szkorupa. (2002)

No. 49 Peace parkland native grassland stewardship program 2001/02, by A. Baker. (2002)

No. 50 Carnivores and corridors in the Crowsnest Pass, by C. Chetkiewicz. (2002)

No. 51 2001 Burrowing owl trend block survey and monitoring, Brooks and Hanna areas, by D. Scobie. (2002)

No. 52 An evaluation of the ferruginous hawk population in Alberta based on recent trend data, by D.P. Stepnisky, G.L. Erickson, J. Iwaasa and B. Taylor. (2002)

No. 53 Alberta amphibian call surveys. A pilot year. Final report, by L. Takats and C. Priestley. (2002)

No. 54 Utilization of a roadside survey technique to survey burrowing owl (*Athene cunicularia hypugaea*) in southeastern Alberta, by J. Nicholson and C. Skiftun. (2002)

No. 55 Alberta species at risk program and projects 2001-2002, by Alberta Sustainable Resource Development, Fish and Wildlife Division. (2002)

No. 56 Developing a habitat-based population viability model for greater sage-grouse in southeastern Alberta, by C.L. Aldridge. (2001)

No. 57 Peregrine falcon surveys and monitoring in the Northeast Boreal Region of Alberta, 2001, by R. Corrigan. (2002)

No. 58 2002 burrowing owl trend block survey and monitoring, Brooks area, by R.F. Russell. (2002)